Application Perspective Case Studies - Hawaiian Species and Habitat Conservation in a shifting climate

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Climate downscaling needs for conservation-driven ecological research in Hawaii: From the heretic to the mundane
Many applied ecology projects utilizing climate projections

- Vulnerability of native Hawaiian plants to climate change
- Shifts in distribution of Hawaiian forest birds
- Shifts in the suitability of Hawaiian landscape to native biomes
- Invasive species degradation under a changing climate
- Changes in landscape carbon storage and fluxes across Hawaii
- Implications of climatic changes to keystone plant species abundance across Hawaii

Spatial resolution of climate projections

- Very high resolution (<500m) projections does not help much!
- At community scale, local factors and processes determine ecological patterns and processes
- Other unpredictable ecological change vectors make fine scale predictions impossible
- High res projections not useful without a finer understanding of current climate and recent past change

- **Focus on wider scenarios, not higher resolution**
Projected MAT change by end of century under RCP 4.5

↑2.3°C
Projected MAT change by end of century under multiple RCPs

↑1.4°C @ RCP 2.6
↑2.3°C @ RCP 4.5
↑4.1°C @ RCP 8.5

Accurate representation of critical climate features to Hawaii conservation

- Importance features that define ecological boundaries
  - TWI: importance for ecology and conservation
  - Kona wet belt and other similar features
  - El Niño frequency
  - Etc.

- Variables beyond precipitation and temperature that partially drive ecological processes
  - Solar radiation
  - PET
  - Cloud water interception
  - Etc.
**Future scenarios**

- Single scenario is of limited use
  - Difficult to prevent a ‘step change’ assumption
- Scenario time periods
  - Two time steps perhaps ideal (mid and late century)
  - Mid-century projections are of greater relevance to decision making
  - Standardized in time intervals for comparison of scenarios

**Model validation**

- We do not need to understand how the model was made, but need clear validation metrics
- Clear metrics for model validation for all variables based on current observations
- At a minimum, a description of the relative strengths and weaknesses of different projected variables
Data formats

- Temporal resolution: monthly, seasonal, annual averages good for >80% of use
- Raster files, not NCDF
- Files standardized in resolution and extent

Case study: HAVO management in a shifting climate
NATIVE PLANT RICHNESS

Preliminary results: not for public dissemination.

Summary of Lessons Learned

• Interaction and regular feedback with managers is critical throughout the project
• Understand spatial and temporal scale needs of managers
• Link model development and interpretation to thresholds of management actions
• Be realistic about how to address rare species with climate model applications